Assignment #12

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Ch20.1

Sample size calculations for estimating proportions

Part A

How large a sample survey would be required to estimate, to within a standard error of ±3%, the proportion of the U.S. population who support the death penalty?

```
# assume that the guessed the population who support the death penalty is 60%
p <- 0.6
# Calculate the sample size needed
n <- (p*(1-p))/(0.03^2)
n
```

```
## [1] 266.6667
```

Part B

About 14% of the U.S. population is Latino. How large would a national sample of Americans have to be in order to estimate, to within a standard error of ±3%, the proportion of Latinos in U.S. who support the death penalty?

```
# assume that the guessed the population who support the death penalty is 50%
p<-0.5
# Calculate the sample size needed
n <- (p*(1-p))/(0.03^2)
n <- n/0.14
n
```

```
## [1] 1984.127
```

Part C

How large would a national sample of Americans have to be in order to estimate, to within a standard error of ±1%, the proportion who are Latino?

```
# assume that the guessed the population who support the death penalty is 50%
p<-0.5
n <- (p*(1-p))/(0.01^2)
n*.14
```

```
## [1] 350
```

Ch20.2

Consider an election with two major candidates, A and B, and a minor candidate, C, who are believed to have support of approximately 45%, 35%, and 20% in the population. A poll is to be conducted with the goal of estimating the difference in support between candidates A and B. How large a sample would you estimate is needed to estimate this difference to within a standard error of 5%? (Hint: consider an outcome variable that is coded as +1, −1, and 0 for supporters of A, B, and C, respectively.)

```
se <- 0.05
# se = sqrt((p1*(1-p1)/0.45n)+(p2*(1-p2)/0.35n))
n <- (0.45+0.35)/(0.45*0.35*0.01)
n
```

```
## [1] 507.9365
```

Ch20.3

Effect size and sample size: consider a toxin that can be tested on animals at different doses. Suppose a typical exposure level for humans is 1 (in some units), and at this level the toxin is hypothesized to introduce a risk of 0.01% of death per person.

Part A

Consider different animal studies, each time assuming a linearity in the dose-response relation (that is, 0.01% risk of death per animal per unit of the toxin), with doses of 1, 100, and 10,000. At each of these exposure levels, what sample size is needed to have 80% power of detecting the effect?

```
# For dose=1
dose <- 1
p <- 0.0001*dose
p.0 <- 0
n <- 2*(p*(1-p)+p.0*(1-p.0))*(2.8/(p-p.0))^2
n
```

```
## [1] 156784.3
```

```
# For dose=100
dose <- 100
p <- 0.0001*dose
p.0 <- 0
n <- 2*(p*(1-p)+p.0*(1-p.0))*(2.8/(p-p.0))^2
n
```

```
## [1] 1552.32
```

```
# For dose=10,000
dose <- 10000
p <- 0.0001*dose
p.0 <- 0
n <- 2*(p*(1-p)+p.0*(1-p.0))*(2.8/(p-p.0))^2
n
```

```
## [1] 0
```

Part B

This time assume that response is a logged function of dose and redo the calculations in (a).

```
# For dose=100
dose <- 100
p <- 0.01*log(dose)
p.0 <- 0
n <- 2*(p*(1-p)+p.0*(1-p.0))*(2.8/(p-p.0))^2
n
```

```
## [1] 324.8069
```

```
# For dose=100
dose <- 100
p <- 0.01*log(dose)
p.0 <- 0
n <- 2*(p*(1-p)+p.0*(1-p.0))*(2.8/(p-p.0))^2
n
```

```
## [1] 324.8069
```

```
# For dose=10,000
dose <- 10000
p <- 0.01*log(dose)
p.0 <- 0
n <- 2*(p*(1-p)+p.0*(1-p.0))*(2.8/(p-p.0))^2
n
```

```
## [1] 154.5634
```